Patent analysis, detection of new markets for employment

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Résumé : En matière de création emploi, les services à la personne et à l'aide aux personnes âgées sont un créneau porteur. Mais, ceci n'est qu'un aspect de la solution, car les appareils, appareillages et systèmes susceptibles d'aider les personnes âgées constituent aussi une source d'emploi à forte valeur ajoutée car de production industrielle. Ce champ d'étude a été analysé à partir de l'APA (Analyse Automatique des Brevets).
La base mondiale des brevets de l'OEB (Office Européen des Brevets), couvre plus de 90 pays et donne accès à environ 80 millions de notices. Cette encyclopédie technologique vivante peut être exploitée via des analyses bibliométriques pour fournir une vision précise de l'évolution de l'environnement technologique lié aux personnes âgées. Après avoir déterminé le plus exactement possible les éléments de l'interrogation de la base, le résultat de la recherche a été téléchargé et analysé. Les différentes tendances : évolution technologique et chronologie des dépôts, déposants, orientations des dépôts par pays, etc. ont été déterminés. Ceci conduit à une connaissance de l'environnement de ce domaine et entre autre les évolutions en cours, les marchés possibles et les principaux acteurs impliqués. Ces résultats sont utiles car ils permettent à des entreprises possédant un savoir proche de celui utilisé dans les brevets sélectionnés d'envisager une diversification dans ce domaine. (Kister & Dou, 2011). Ensuite une interrogation d'une base de données de publications scientifiques pourra compléter l'analyse pour analyser le monde de la recherche scientifique dans le domaine et initier des rapprochements avec le monde industriel.

Mots-clés : brevet, innovation, emploi, industrie, senior

Summary: As regards of employment creation, the services for the elderly are an expending market area. But, this is only one aspect of the solution, because the apparatuses, equipment and systems likely to help the elderly people constitute also a source of employment of high added value for industrial production. This field of study is analyzed using the APA (Automatic Patent Analysis).
The world patent database from the EPO (the European Patent Office), covers more than 90 countries and provides access to approximately 80 million notices. This living technological encyclopedia can be exploited via bibliometric analysis to provide an accurate view of the trend of the technological environment related to the elderly people. After having determined the most exactly as possible the elements of querying the base, the search result was downloaded and analyzed. Various tendencies were determined: technological change and chronology of patent deposits, applicants, orientations of the R&D by country, etc. This leads to knowledge of the environment of this field and among other current developments, potential markets and the main actors as well as the possible entrants. These results are useful because they allow companies having competencies close to that used in the patents selected, to consider a diversification in this field. (Kister & Dou, 2011). Then a query on a database of scientific publications will be able to supplement the patent information to analyze the world of the scientific research in the field and to initiate possible PPP (Public and Private Partnerships) between industry, research and policy makers.

Key Words : patent, innovation, employment, industry, senior

1. Introduction

The aging of the population in the developed countries becomes a major concern of the states. Indeed, its impact is important on the level of the social security and retirement, but poses also the problem of the accompaniment in this stage of life (Dou Goarin, 2014). Evolution of technologies, that it is electronics, the networks (Internet, domestic networks…), micromechanics, opens new possibilities for care, assist, comfort and safety. It is therefore important for the companies, state institutions, health care staffs, to know what will be the possible evolutions in this branch of industry. The objective is multiple: the knowledge of the sector, but also the use of these new technologies in the field of research to guide or modify the ongoing programs and to finish, offer to the companies, (Small and middle size industries), the possibility of diversifying so preserving their market share (and thus employment) and expand on new markets.

2. Materials and methods

The interest for the patents is increasing, that is due to the fact that the economy is based primarily on the knowledge of technologies, main source of value. Their appropriation is thus a dominating challenge. As a legal instrument of appropriation of a technology, the patent naturally constitutes an essential component of the new economic play. (Van Zeebroeck, 2008)

Although information Patent is more delicate to apprehend than the standard scientific publication, it is one of the best indexes of the process of innovation. The companies which perform R & D handle it the every day and constituted an expert testimony which can be developed in other contexts and other scopes of application. (Blanchard, 2006)

Then a crossing of this information collected with the Medline database will make it possible to know the scientific laboratories and organizations which work on the field detected during the APA in order to initiate PPP (Public and Private Partnerships).

2.1 Patents

The world patent database accessible via the European Patent Office (EPO)[1] covers more than 90 countries and contains approximately 80 million notices. It is updated regularly and if it is not completely exhaustive (certain national offices do not transmit the information), it covers the principal countries as well as the world and European patents. Research on the database is carried out with a Boolean combination of key words present in the title or abstract and if necessary of terms of the international patent classification (IPC)[2], which allows you to select the scopes of application and technologies. Once the research is completed, the selection of notices is downloaded and the analyses can be performed with a specific software, as Matheo-Patent[3]. The most delicate part is the realization of a rather broad equation of research, covering the subject. The clarification of this one is carried out by successive iterations, to lead to the following request:

(elderly or « old people ») and (apparatus or device)

[1] http://worldwide.espacenet.com/?locale=fr_EP

[2] http://worldwide.espacenet.com/classification?locale=en_EP

[3] http://www.matheo-software.com/fr/produits/matheo-patent.html

old people is used in the search as a string search,
dates : the search limit is 2000 to 2013 (May)
The search is done in titles and abstracts

Number of selected patents : 1776

2.2 Bibliometric analysis

The bibliometry is a measuring instrument and analysis based on the use of statistical techniques, which aims to assist in the comparison and understanding of large set of bibliographical elements though various correlations (Rostaing, 1996). In our study we use this technique to analyze the set of selected patent notices.
The query, extraction of patents notices as well as the analyses are performed using the software Matheo-Patent.
These bibliometric analysis were largely described in many scientific publications (Dou, Mohellebi, & Kister, 2012) and also in videos[4] available on Internet. Concerning the bibliometric analysis, the combinations between the various documentary fields of the patent notices are very numerous and knowing that new fields can be created by the users by extraction of data from the corpus related to the initial research, only the most significant results will be presented.
The bibliometrics on patents present many advantages because they cover almost all the technological fields and are classified by topic in a precise way. For each patent, it will be possible to know information such as the inventor, the applicants, the technologies, the trend in technology or deposit… In addition, the patent guarantees inventiveness and anteriority thanks to the examination procedure. Finally, the patents are systematically indexed in databases, such as the European Patent Office which was questioned for this analysis. (Barred Laville &, 1994)

3. Results

At first, it is a question of measuring the evolution of the patent fillings.
The distribution of patents and families per years is as follows:

C	Name	Patent	Family
	2013	41	34
	2012	139	115
	2011	204	155
	2010	179	138
	2009	148	125
	2008	160	113
	2007	148	128
	2006	150	123
	2005	143	117
	2004	116	100
	2003	104	78
	2002	82	64
	2001	79	51
	2000	52	37

Figure 1 : Distribution of patents per years

[4] See Youtube Matheo Software examples https://www.youtube.com/user/MatheoSoftware

The distribution of the patents per years shows a growth around the year 200 and a regular growth (last two years is not fully indexed in the database). However, the number of patents concerned remains overall weak for a field which socially will represent an unquestionable problem in the years to come.

Families distribution of WO (world) and Europeans (EP) patents per countries:

	USA	Japan	China	Australia	Germany	Korea	Great Britain	France	italy
WO	49	29	24	26	13	17	8	5	3
EP	38	25	22	16	19	12	5	4	3

In Fact the USA, Japan, China are the most productive countries. The case of Australia is different because the analysis of the Australian patents shows, that except for two patents, that those are patents extended in Australia by other countries. Germany and South Korea setting up a second group, the last group being the United Kingdom, France and Italy

Figure 2 : Distribution by country of the world and European patents

The knowledge of the World and European patents is important because these patents are regarded as most important. See on this subject the work of the Economic Cooperation Organization and Development(OECD, 2004) (OECD, 2009).

The comparison between extended patents and priority patents allows to deduce the technological dependence of a country. Indeed, the delta of these data allows us to know how many patents are registered by structures from other countries.

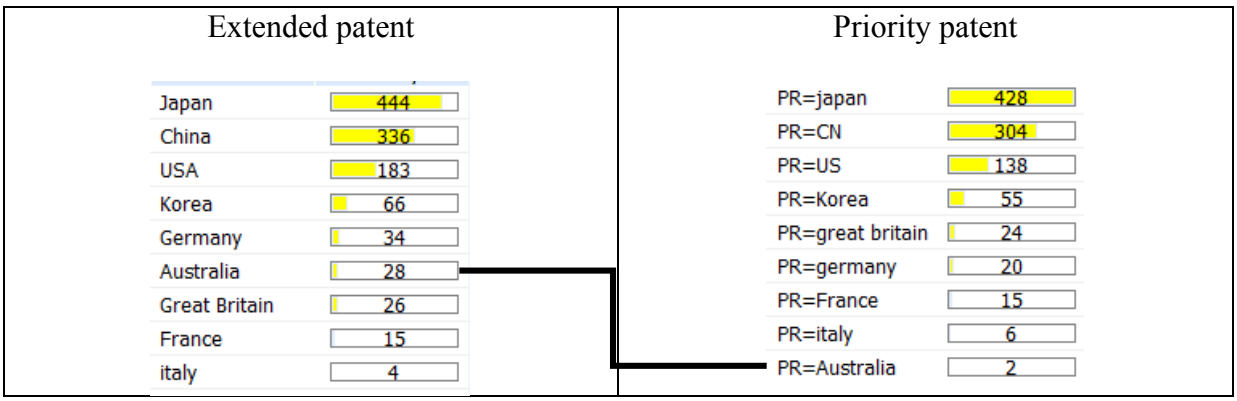

Figure 3 : Comparison between priority and extended patents

The case of Australia is particular in that only two out of the 28 patents observed are actually australian patents. Other patents are priority patents from USA, France,… extended in Australia. One possible question is why such extensions are carried out in this country ?
whereas the population pyramid does not show a characteristic aging. An analysis of the population and especially its development shows that in the coming decades, Australia will face a significant aging of its population, with a doubling of the number of people aged over 65 by the year 2045. (Thorne, 2007)

In addition, the number of extended patents in China and Japan is low compared to the USA. This specifies an economic trend in this country: the elderly people in the USA are relatively numerous and have enough financial condition to access devices facilitating continuity of life in the best conditions. As regards France, there is no extension, which would tend to show that the market in this field is not sufficiently important. As against the small number of patents indicates that there would be a possible niche for innovative companies.

From the number of patents filled, three countries are largely dominant. They are Japan, China and the USA. But China, with practically no extension of its patents (cf. next figure),

remains thus two countries “leaders” in the field, **Japan** and the **USA** and with a lesser degree South Korea. The fact that China doesn't have patent extension to other countries suggests that there is some competition in the domestic market, but also that the no -extended Chinese patents constitute a barrier against foreign patents in China? Thus, by this method, China protects its domestic market from competition. (Dou & Dou 2013).

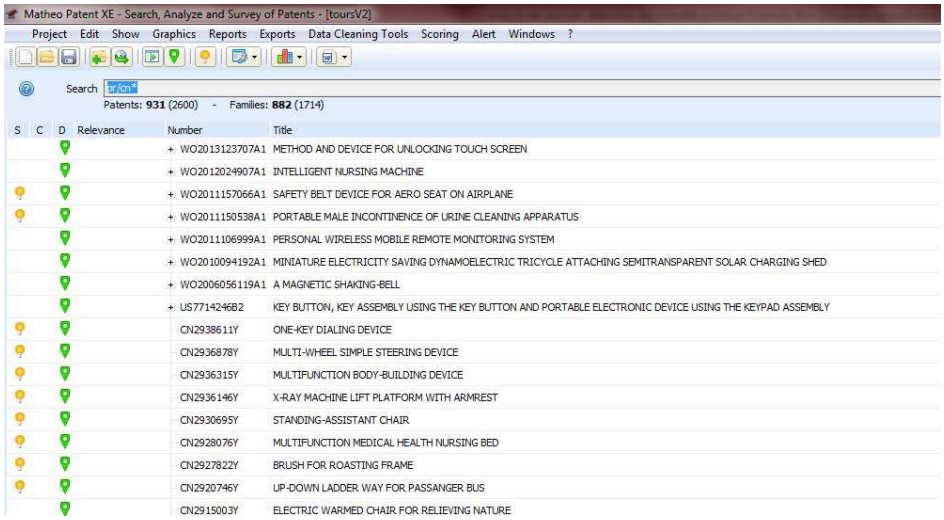

Figure 4 : Extended patents in China

4. The main technological domains

4.1 Method

The analysis uses various IPC codes present in the patent notices. This classification is used to divide the applications and technologies in various fields. They comprise 8 digits for the maximum precision, but generally the statistical analysis is done on the level of 4 digits. The list of the IPC and their significance is directly accessible via Internet[5].

4.2 Technological domains

The principal technologies being the object of a R & D are the following ones:

CIB 4 digits	signification
A61H 107 families	Physical therapy apparatus, e.g. Devices for locating or stimulating reflex points in the body; artificial respiration; massage; bathing devices for special therapeutic or hygienic purposes or specific parts of the body
A61G 107 families	Transport or accommodation for patients; operating tables or chairs; chairs for dentistry; funereal devices
G08B 106 families	Signalling or calling systems; order telegraphs; alarm systems
A63B 88 families	Apparatus for physical training, gymnastics, swimming, climbing, or fencing; ball games; training equipment
A61B 85 families	Diagnosis; surgery; identification
A47K 74 families	Sanitary equipment not otherwise provided for
H04M 71 families	Telephonic communication
G06F 69 families	Electric digital data processing
A61F 55 families	Filters implantable into blood vessels; prostheses; orthopaedic, nursing or contraceptive devices; fomentation; treatment or protection of eyes or ears; bandages, dressings or absorbent

[5] http://web2.wipo.int/ipcpub/#lang=fr&menulang=FR&refresh=page

	pads; first-aid kits
H04N 53 families	Pictorial communication,
H61M 41 families	Devices for introducing media into, or onto, the body
G06Q 38 families	Data processing systems or methods, specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes; systems or methods specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes, not otherwise provided for

Tableau 1 : The main technological domains

4.3 Main technological orientations between Japan, USA and China:

Figure 5 : The main technological orientations of Japan

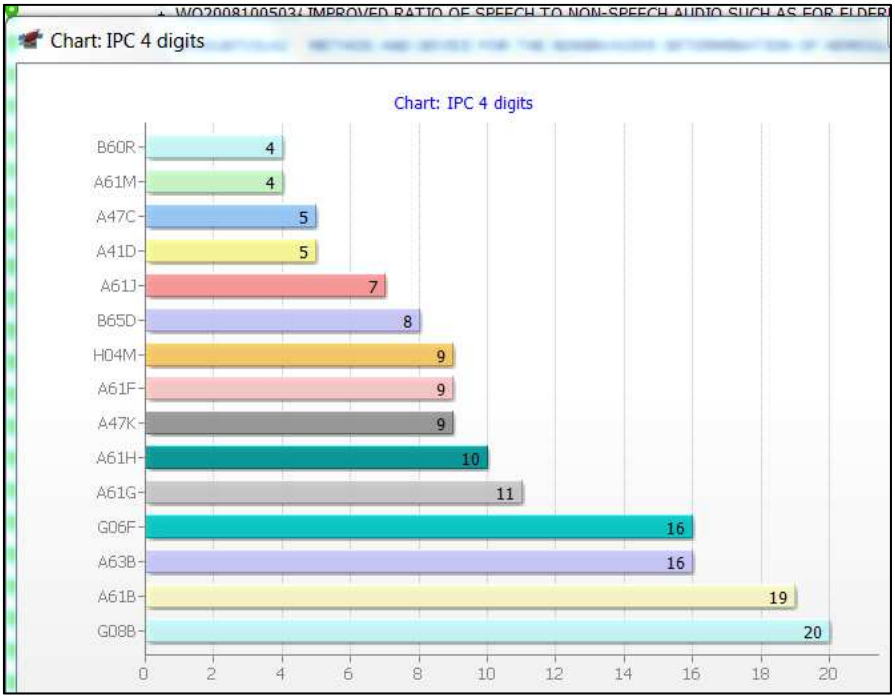

Figure 6 : The main technological orientations of USA

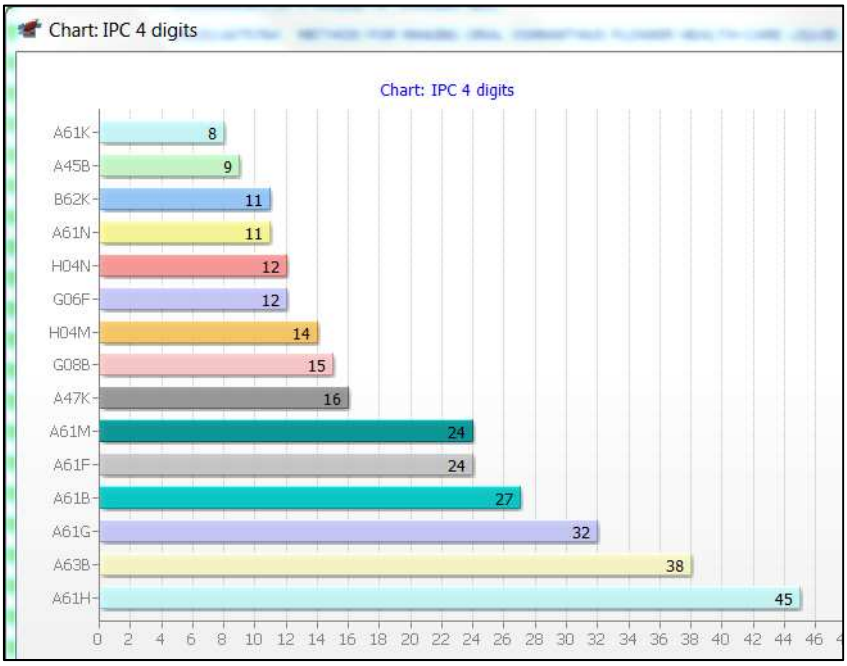

Figure 7 : The main technological orientations of China

By analyzing these data, the major differences between countries may occur. This is the case for the following IPC codes :

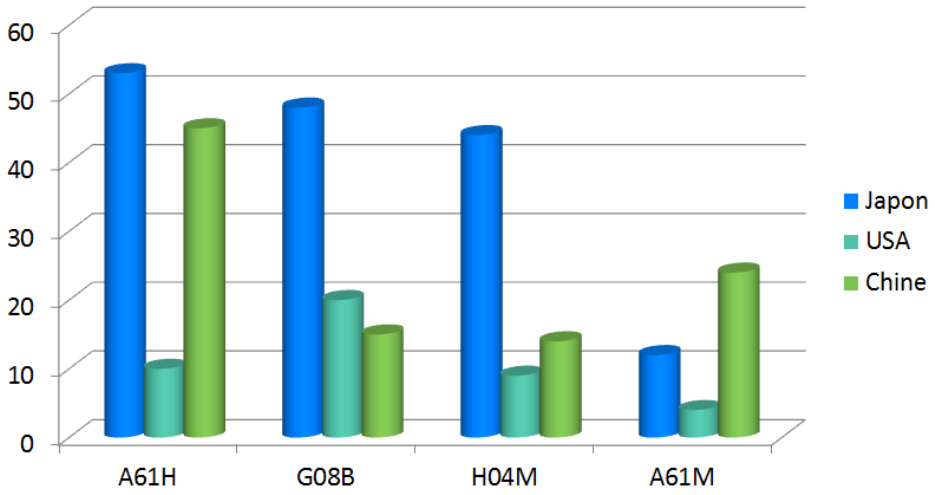

Figure 8 : Technological differentiation

CIB	Description of the IPC
A61H	Physical therapy apparatus, e.g. Devices for locating or stimulating reflex points in the body; artificial respiration; massage; bathing devices for special therapeutic or hygienic purposes or specific parts of the body
G08B	Signalling or calling systems; order telegraphs; alarm systems
H04M	Telephonic communication
A61M	Devices for introducing media into, or onto, the body

Tableau 2 : Significance of the principal IPC differentiating Japan, the USA and China

It is remarkable to see that Japan, whose renewal rate of the population is low uses this social evolution to develop research and applications in the field of assistance to seniors and that these developments leads it to be the leader. It is also interesting to note that Germany whose population is aging does not produce constant effort in the field, as well as Russia which is practically in the same case.

In order to identify the differences in technological development between countries, a graph will make it possible to visualize the network of the common IPC and the different IPC. This

allows a more detailed analytical vision presented in the following figure. In this network are gathered the common IPC to the two or three countries in the center, to outside leave only the IPC which are only related to only one country.

Japan carries out technological applications in very various fields. This confirms its leading position and foreshadows that in the field of the equipment for seniors, Japan applies a policy of research and development similar to that carried out in the field of the video and cameras. This implies that the other countries which would like to diversify into the field an acceleration of research and development are necessary. If waiting too long the Japanese development policy will leave nothing any more but only one very low place to the innovations form elsewhere.

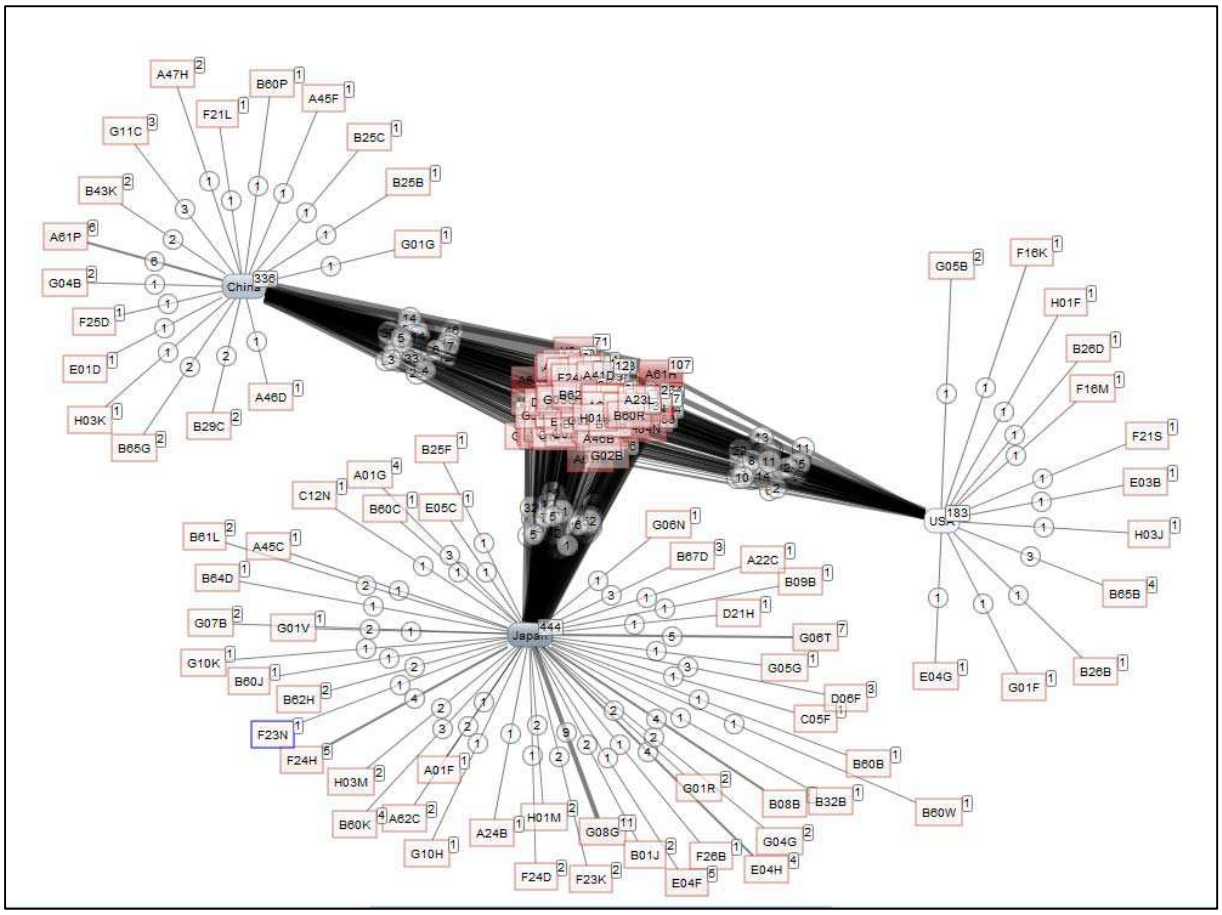

Figure 9 : Diversification between Japan, China and the USA

5. The main actors in this market

The analysis of a corpus of patents can also allow a better understanding the actors of a market, or industry.

The filling companies can be to also analyzed: their differences, new companies in the sector (recent patents) or that which have a constant position, etc
For example the following figure shows, for Japan, the appearance of patent applicants in time. Those who file patents in a constant way are the best-known competitors, who had no previous deposit but had recent one can be considered as new entrant in the meaning of the Porter's five forces (Porter, 2010).

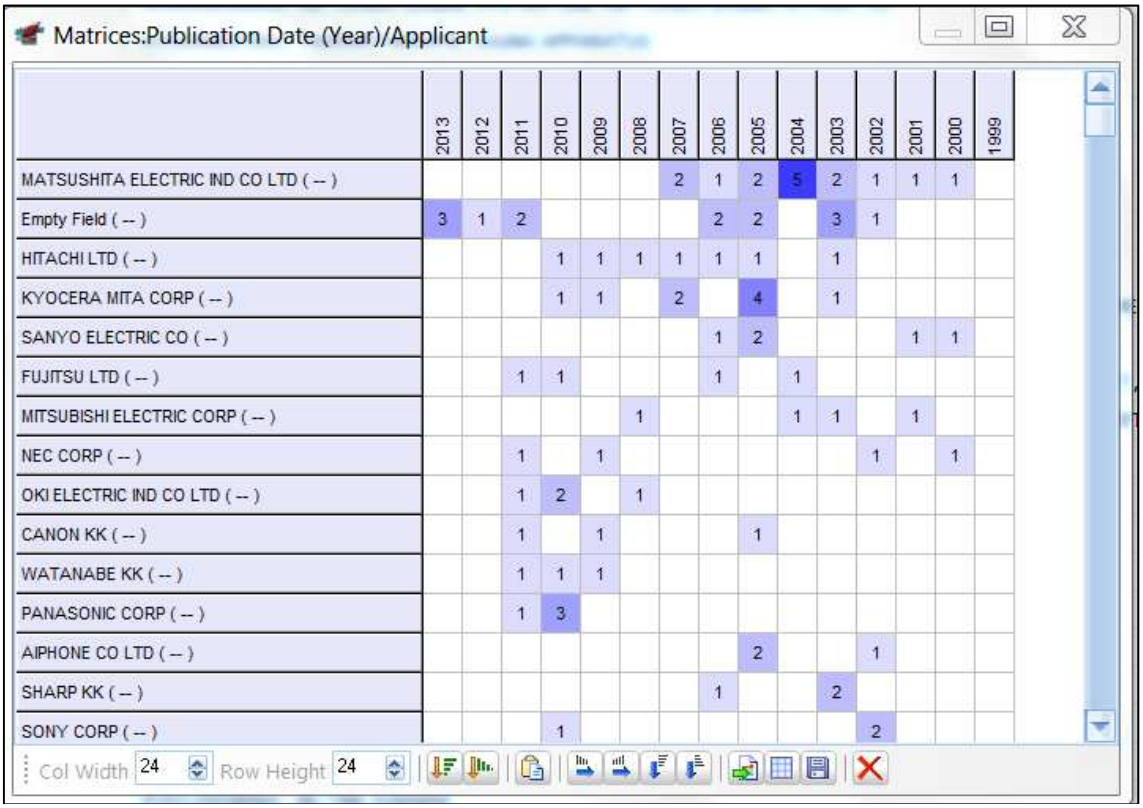

Figure 10 : Distribution of the patent fillings by Japanese companies in time (partial view)

6. From products and applications to research

By reconciling the information analyzed and a scientific database, it is possible to link the products and services to fundamental research. Analysis of the IPC codes of the patent database led us to use medical database: MedLine. This database is accessible via the Pubmed host[6]. This database is free and results can be downloaded in a format allowing bibliometric analysis. This database contains 22 million notices and covers the medical field and part of the biomedical. Take for example the following patent:

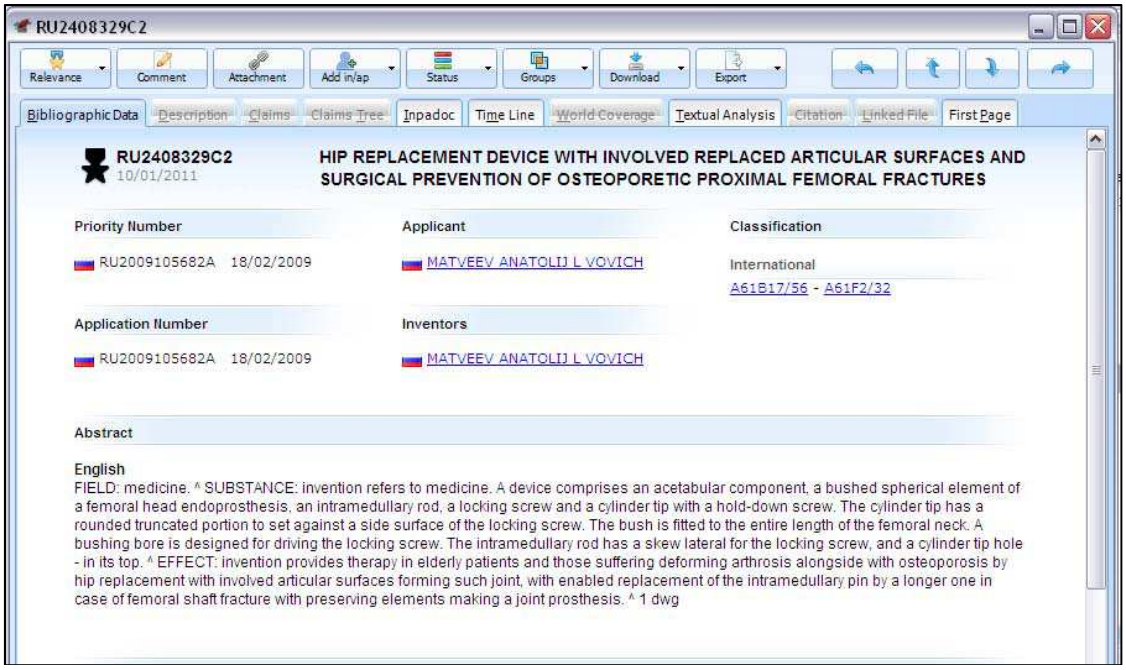

Figure 11 : Treating Example of interesting patent of the problems of hip prosthesis

[6] http://www.ncbi.nlm.nih.gov/pubmed

A quick analysis can detect two particularly interesting terms: endoprosthesis and hip. These two terms can be used as search terms in the title and the abstract of the MedLine database, 1002 references are thus recovered.

Figure 12 : Example of references from "Medline" about the subject

These 1002 references or a reference group more reduced (combination with other significant terms) can be downloaded and analyzed in the same way as patents (using Matheo-Analyzer)[7]. It will be possible to know the current research, or detect laboratories for possible collaborations, etc

Another way of creating link between patents and research is to seek the patents which the applicant is a research center or a university. For example in research conducted in the framework of this work, figure 11 highlights patents filled by universities or research centers.

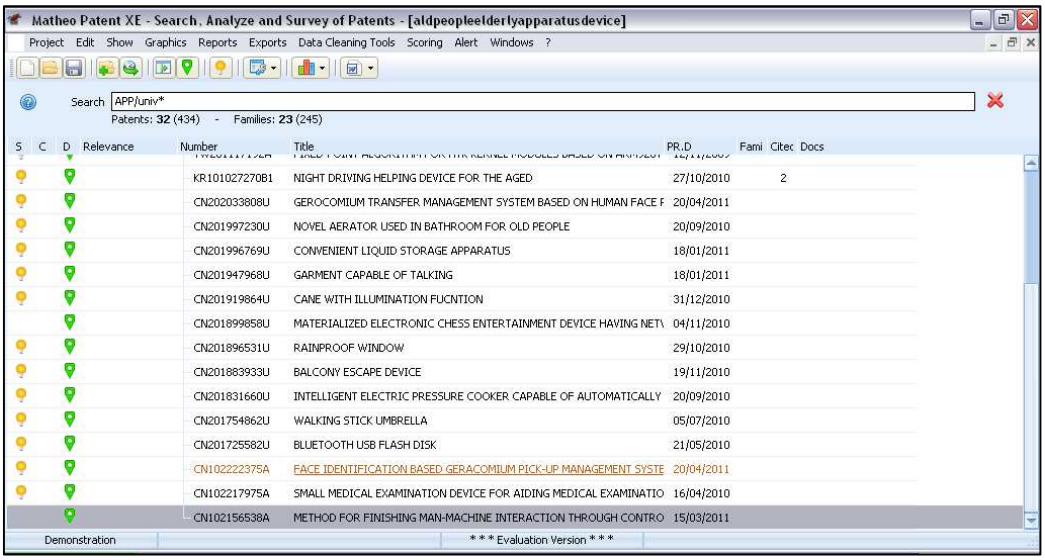

Figure 13 : Patents deposited by universities or research centers for the year 2011

With the name of the university and the name of the inventor, a search with Google or Google Scholar for example, will establish a direct link toward fundamental researches conduct edin the field.

[7] See http://www.matheo-software.com

Figure 14 : Patent used for Internet search

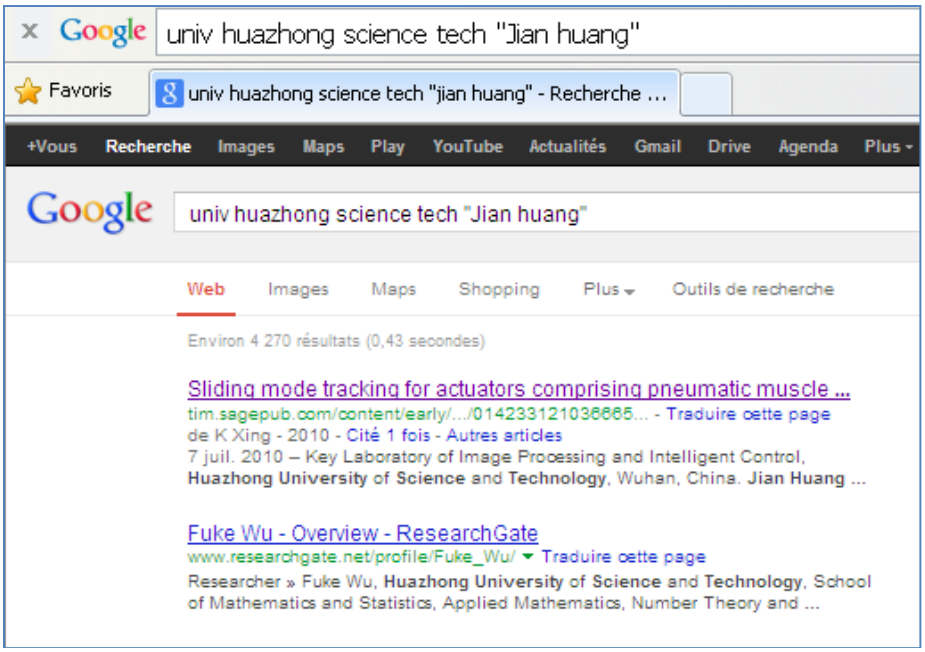

Figure 15 : Search with Google

Figure 16 : Preceding Search results

7. To develop a watching system

To be permanently informed about technologies and various protagonists of the field, the installation of a monitoring system will have the updated information while saving time.
Having researched on the Google engine, the widely used at present time, the setting of Google Alerts is the best way to be informed.
It will be possible to detect the innovations in the Google indexed data: it is to say also all the new resources (News, blog, Web…) with the keywords specified will be sent via email. This will facilitate the watching process since there is no need to query manually Internet any more

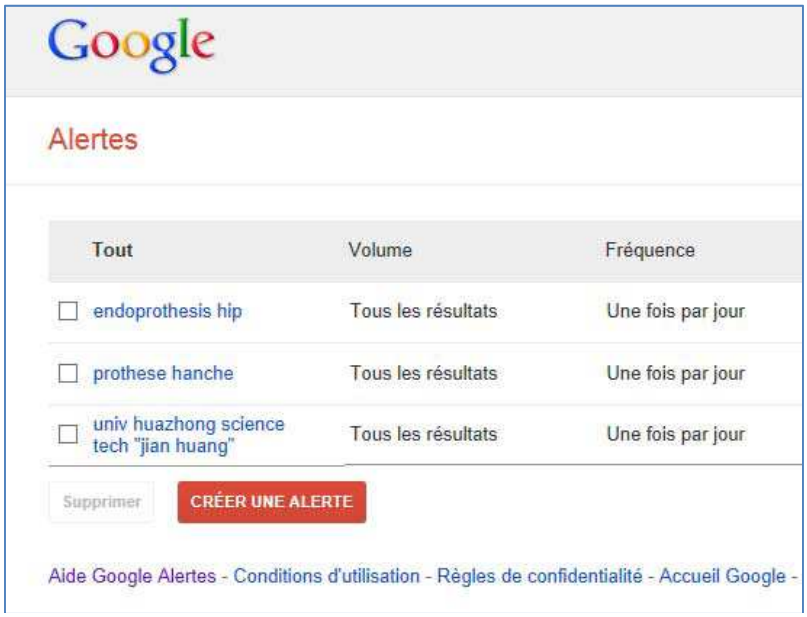

Figure 17 : Example of the development of an alert index

The advantage of such a system is that it uses a Push technology and in addition, it is free.
With the same approach, it is possible to make these alerts on Google Scholar in order to know the innovations of the scientific world.

Many other tools can be set up, free or paying to remain informed of its field and on its market. That is not the object of this publication but let us say that most of the time they are concerned by Internet searches. Commercial databases (with generally need large financial facilities also offer various systems to query and analyzed (mostly by developing lists of terms) the adequate databases such as Chemical Abstracts, Compendex (Applied Physics), etc.

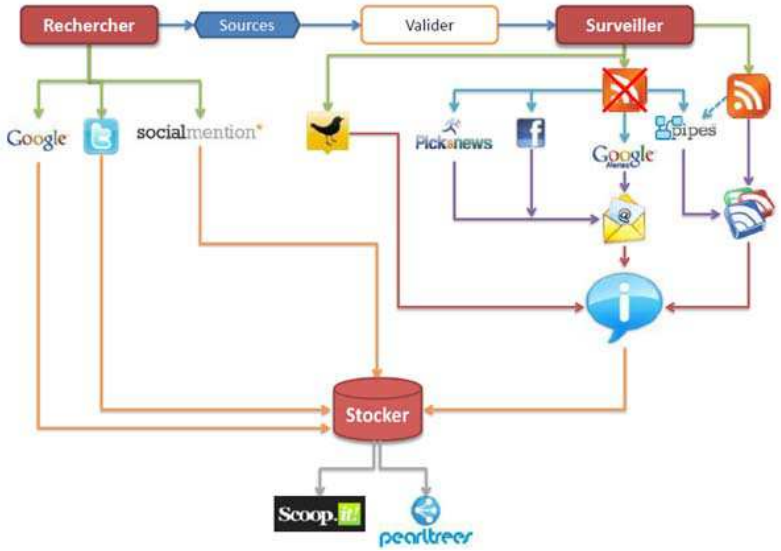

Figure 18 : example of watching system with free tools

8. Conclusion

This analysis highlights in a field in development and creator of employment, the major technological trends through analysis of patents from the present in the world patent database. Thus Japan, China and the USA have different strategies. This potentially allows companies wishing to undertake a diversification in the field not to begin their work on R & D or their prospective thoughts without being aware of current trends of main technologies and of possible innovations for technologies not shared between these three countries. In the same way the identification of the applicants help to identify possible partnerships, to better know the networks of inventors and thus able to approach the subjects of the equipment intended for elderly people without taking the risk to launch a dead-end development.
In the same purpose, the Ministry of Research and Education has established a public policy to encourage economic intelligence in university to facility the integration into the economic system as a source of innovation (Délégation interministérielle à l'intelligence économique, 2013). Scientific and technical intelligence, analyzing patent databases and scientific databases, as shown in the above methodology will detect and analyze many vital information: analyzes of subjects of research, positioning the institution and partners at the global and national level, market and promote innovation ... and the influence of French research.

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List of the figures and tables